OTT HydroMet

Lufft
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NIRS31 Non Invasive Road Sensor

Operational Manual

48.7230-NIRS31E | V8.6 (08/2024)

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Table of contents

1 Scope of supply

The following items are included with delivery:

- Non-invasive road sensor
- Mast clamp
- Sounding pipe

2 Order numbers and variant code

2.1 Product variants

Variant	Order number
NIRS31-UMB	8710.UT01

2.2 Accessories and spare parts

2.2.1 Accessories

Item	Order number
Power supply unit 24 V/100 VA	8366.USV1
ISOCON-UMB	8160.UISO
Surge protection	8379.USP
Lufft sensor cable 15 m	8371.UK015
Connection cable 30 m	8371.UK030

2.2.2 Spare parts

Item	Order number
Reflector unit	8710.ULAMP

3 About this manual

This operational manual is designed for devices manufactured from November 2022.

3.1 Other applicable documents and software

The following documents contain further information on installation, maintenance and calibration:

- NIRS31 Installation Guide and Checklist
- Operating Manual UMB ISO Converter ISOCON
- Operating instructions surge protection

The following documents and software can be downloaded at www.lufft.com:

- ConfigTool.NET
- UMB protocol description
- Firmware

3.2 General signs and symbols

The signs and symbols used in the operational manual have the following meaning:

Practical tip

i This symbol indicates important and useful information.

Action

✓ Prerequisite that must be met before performing an action.

▸ Step 1

⇨ Intermediate result of an action

▸ Step 2

⇨ Result of a completed action

List

- List item, 1st level
  - List item, 2nd level

3.3 Explanation of warnings

To avoid personal injury and material damage, you must observe the safety information and warnings in the operating manual. The warnings use the following danger levels:

WARNING

WARNING

This indicates a potentially hazardous situation. If the hazardous situation is not avoided, it may result in death or serious injuries.

CAUTION

CAUTION

This indicates a potentially hazardous situation. If the hazardous situation is not avoided, it may result in moderately serious or minor injuries.

NOTICE

NOTE

This indicates a situation from which damage may arise. If the situation is not avoided, products may be damaged.

4 General safety instructions

4.1 Intended use

The Non Invasive Road Sensor (NIRS31-UMB) is used outdoors to measure various values to determine the corresponding road or runway conditions. The sensor is mounted on a sign gantry or mast with a mast bracket.

At certain measuring points such as sign gantrys the non-invasive sensor can be used as an alternative to the built-in road sensor IRS31-UMB.

4.2 Potential misuse

Any use of the product that does not comply with the intended use, be this intentional or negligent, is forbidden by the manufacturer.

- Use the product only as described in the operational manual.

4.3 Personnel qualification

The equipment described in this manual must be installed, operated, maintained and repaired by qualified personnel only.

- Obtain training from OTT HydroMet if necessary.

4.4 Operator obligations

The installer is responsible for observing the safety regulations. Unqualified personnel working on the product can cause risks that could lead to serious injury.

- Have all activities carried out by qualified personnel.
- Ensure that everybody who works on or with the product has read and understood the operational manual.
- Ensure that safety information is observed.
- File the operational manual together with the documentation of the entire system and ensure that it is accessible at all times.
- The operational manual is part of the product, forward the operational manual together with the product.

4.5 Personnel obligations

To avoid equipment damage and injury when handling the product, personnel are obliged to the following:

- Read the operational manual carefully before using the product for the first time.
- Pay attention to all safety information and warnings.
- If you do not understand the information and procedure explanations in this manual, stop the action and contact the service provider for assistance.
- Wear the necessary personal protective equipment.

4.6 Correct handling

If the product is not installed, used and maintained correctly, there is a risk of injury. The manufacturer does not accept any liability for personal injury or material damage resulting from incorrect handling.

- Install and operate the product under the technical conditions described in the operational manual.
- Do not change or convert the product in any way.
- Do not perform any repairs yourself.
- Get OTT HydroMet to examine and repair any defects.

- Ensure that the product is correctly disposed of. Do not dispose of it in household waste.

4.7 Health hazards

4.7.1 Risk of electrical shock

Live parts can cause electric shocks in the event of contact.

- Never take measurements on live electrical parts.
- Never touch live electrical parts.

4.8 Working outdoor

4.8.1 Installation and maintenance at great heights

It is advised to mount the product in a certain height. Therefore, there is a risk of falling down.

- Observe and follow the local safety regulations.
- Use suitable safety equipment.
- Inspect the safety equipment before use.
- Secure the person mounting or maintaining the device against falling down.
- Secure the device against falling down.

4.8.2 Using long cables

Long cables are required to mount the product at great heights. Therefore, there is a risk of strangulation.

- Use long cables properly.
- Observe manufacturer's instructions.
- Observe safety regulations.

4.8.3 Working at roadside

The device can be installed on a mast or on a sign gantry at the roadside. Special safety regulations apply to prevent accidents and injuries.

- Observe the safety regulations for working at the roadside and in the vicinity of the road carriageway.

4.9 Certification

4.9.1 Europe, USA and Canada

CE (EU)

The equipment meets the essential requirements of EMC Directive 2014/30/EU.

FCC (US)

FCC Part 15, Class "A" Limits

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

IC (CA)
Canadian Radio Interference-Causing Equipment Regulation, ICES-003, "Class A"

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numèrique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

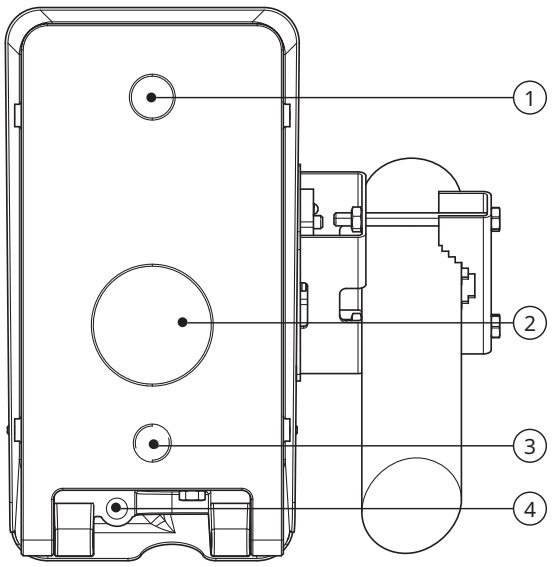
5 Product description

5.1 Design and function

The non-invasive road sensors are used for road weather monitoring. The device measures the surface temperature, water film height and ice layer thickness on the road by means of non-invasive optical spectroscopy and a pyrometer. Thus the device can be used for the acquisition of a variety of measurement variables to determine the corresponding road conditions relevant for winter maintenance services.

The equipment is connected by way of an 8-pin plug-in terminal and associated connection cable (length 15 m or 30 m). The measured values are requested over the RS-485 interface in accordance with UMB protocol. During commissioning, configuration and verification takes place using the ConfigTool.NET software.

5.2 Product overview



1	Receiver	3	Pyrometer
2	Reflector unit	4	Sounding pipe

6 Transport, storage, and unpacking

6.1 Unpacking

- Use two people to carefully remove the product from the packaging.
- Check that the delivery is complete and undamaged.
- If you find any damage or if the delivery is incomplete, then immediately contact your supplier or manufacturer.
- Keep the original packaging for any further transportation.

6.2 Storage

- Store within specified temperature ranges.
- Store in dry area.
- Store in original box where possible.

7 Installation

7.1 Mechanical installation

7.1.1 Required tools and aids

The following tools and aids are required:

– two open-end or box wrenches, SW 17

7.1.2 Choosing a site

WARNING

Risk of injury due to improper installation!

If the mast or the device is installed improperly, damage to the device and injury to people may result.

- Ensure that the mast stands on a stable surface.
- Ensure that the mast is sized and anchored appropriately.
- Ensure that the mast is earthed in accordance with the regulations.
- Use only approved and tested appliances (conductors, risers etc.) to install the device on the mast.
- Ensure to tighten the screws firmly.

- Ensure the following at the site:

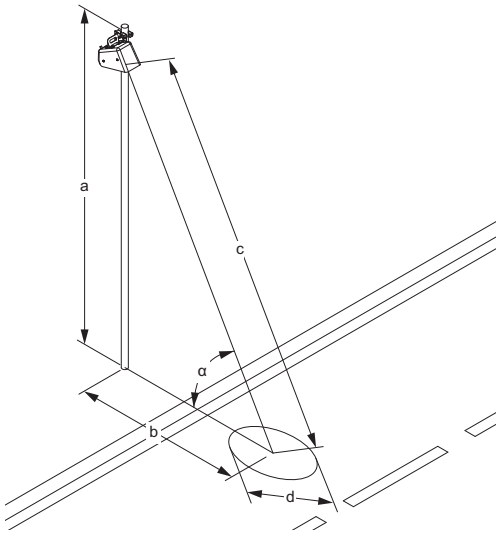
– Free access to the equipment for maintenance works

– Reliable power supply for permanent operation

– Good network coverage when transmitting over a mobile communications network

7.1.3 Installing device

Installation of the device either on a mast or on a sign gantry:

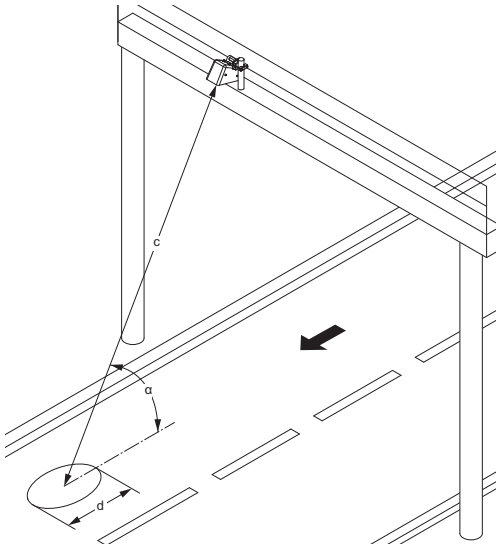


Installation on a mast

c Measurement distance 6 to 15 m

α Measurement angle between 45 and 85°

d Measurement surface diameter = c / 10



Installation on a sign gantry

c Measurement distance 6 to 15 m

α Measurement angle between 45 and 85°

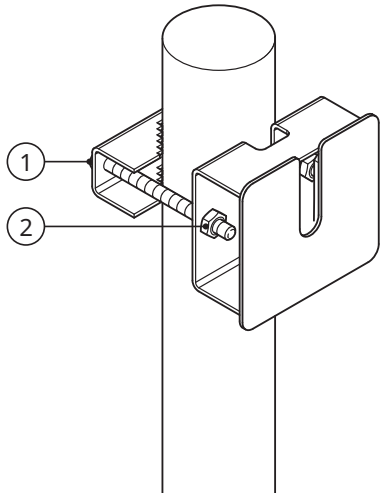
d Measurement surface diameter = c / 10

- Ensure there are two people at the installation site to install the device.
- Install the device on the mast or sign gantry.
- Keep a measurement distance of 6 to 15 m between the device and the road surface.
- Chose a measurement surface on the roadway free of disturbances and flaws.
- Align the sensor with the center of the roadway while retaining the angle of measurement (between 45 and 85°).

7.1.4 Fastening mast bracket

The mast bracket is designed to be installed on a mast with a diameter of 60 to 76 mm.

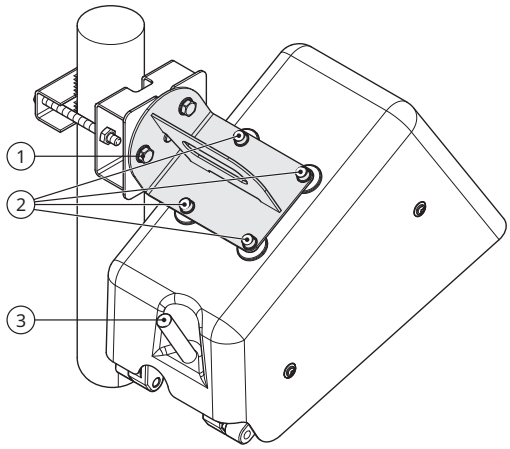
The bolt length varies depending on the diameter of the mast. For mast diameter 60 to 69 mm, select bolt with 100 mm length, for mast diameter 70 to 76 mm, select bolt with 120 mm length.



1 Bolt
2 Nut

- Loosen the nuts.
- Push the bracket onto the mast from above at the desired height.
- Attach the bracket to the mast with the bolts, nuts and washers.
- Hold the nut firmly with one wrench.
- Tighten the bolt evenly and secure with the second wrench.

7.1.5 Aligning and fastening device



1 Bolts with washer on bracket
2 Bolts on sensor
3 Sounding pipe

Depending on which side of the mast the sensor is to be attached, the bracket on the sensor must be adjusted prior to installation: the sensor bracket can be rotated by 180° and reattached on the sensor.

- To adjust the bracket on the sensor, remove the four bolts on the bracket attaching the sensor (2).
- Remove the sensor.
- Rotate the bracket by 180°.

- Fasten the bracket with the bolts to the sensor (2).
- Push the device onto the bracket on the mast from above.
- Fasten the device with the bolts and washers (1).
- Tighten the bolts (2), but make sure that the device can still be moved.

The device must be aligned with the center of the roadway, while retaining the angle of measurement (between 45 and 85°). A look through the sounding pipe on the bottom of the sensor indicates the center of the measurement field on the road surface. The measurement surface must be free of disturbances and flaws.

- Insert the sounding pipe (3) at the bottom of the sensor.
- Look through the tube to check the measurement field on the road surface is free of disturbances.
- Align the device with the center of the roadway.
- Do not point the sensor toward oncoming traffic.
- Tighten the bolts firmly.
- Remove the sounding pipe.

7.2 Electrical installation

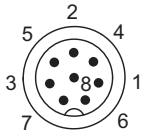
7.2.1 Electrical connections

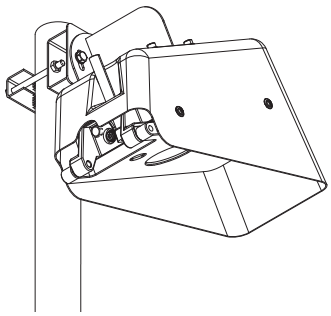
WARNING

Electric shock due to incorrectly connected device!
If the device is not connected correctly, it may be permanently damaged and an electric shock may result.

- Ensure that the device is connected correctly.
- Ensure that the cable shielding is not connected to earth in the electrical cabinet.

There is an 8-pin screw plug on the underside of the device, which is keyed. This serves to connect the supply voltage and the interface via the connection cable.





Pin assignment

Number	Color	Assignment
1	Pink	Not connected
2	Yellow	RS-485_B (-) or SDI-12 data line
3	Red	Not connected
4	Grey	Not connected

Number	Color	Assignment
5	Green	RS-485_A (+)
6	Blue	Not connected
7	White	Supply voltage ground and SDI-12_GND
8	Brown	Positive supply voltage

7.2.1.1 Connecting devices in SDI-12 mode

The RS-485 interface can be switched to SDI-12 via the sensor configuration.

Power supply by the SDI-12 bus

Number	Color	Assignment
1	White	SDI-12_GND
2	Brown	Positive supply voltage
3	Green	Not connected
4	Yellow	SDI-12 signal

Pin assignment: Supply voltage and SDI-12

- Connect the communication lines SDI-12_GND and SDI-12 signal.
- Connect the white and brown wires to the power supply unit.

7.2.2 Supply voltage

The supply voltage is 24 V DC. The power supply unit used must be approved for operation with equipment of protection class III (SELV).

> The supply voltage must be available at the sensor. Ensure that the voltage drop of the supply line is considered.

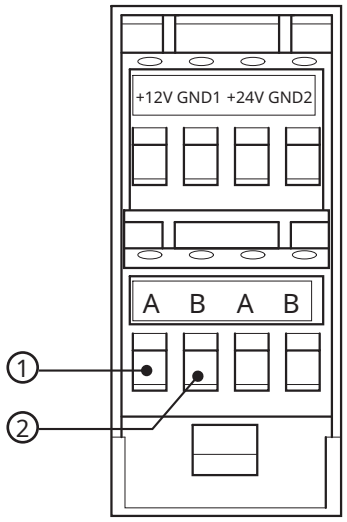
The voltage drop when using the Lufft sensor cable 15 m is approx. 1.2 V. The bias voltage at the power supply unit should ideally be higher by this amount. Since the sensor consumes less power in energy saving mode, the voltage drop is lower in this case, which should be taken into account when selecting the maximum voltage at the power supply unit. The maximum voltage applied to the sensor must not exceed 28 V DC. If longer cable lengths than 30 m are required, the original cable should be run as short as possible to a terminal box. The further connection to the control cabinet must be provided with a larger conductor cross-section.

7.2.3 RS-485 Interface

The device has an electrically isolated, half-duplex, 2 wire RS-485 interface for configuration, measurement polling and the firmware update. The RS-485 interface has a default baud rate of 19200 (no parity, 8 data bits, 1 stop bit), but other baud rates are supported (adjustable baud rates: 1200, 2400, 4800, 9600, 14400, 28800, 57600).

7.2.4 Connecting ISOCON-UMB converter

The ISOCON-UMB communication module converts RS-485 into RS-232.



1 Green: RS-485 interface A

2 Yellow: RS-485 interface B

- Connect the green and yellow wires to the ISOCON-UMB converter.
- Connect the brown and white wires directly to the power supply unit, not to the ISOCON-UMB converter.
- Refer to the operating manual UMB ISO converter ISOCON.

i If the sensors are connected to a Lufft LCOM-UMB the NIRS31-UMB should not use the UMB voltage output of the LCOM (GUB1/GMS) but connect directly to the power supply unit. To keep the LCOM function of resetting sensors on the UMB bus by cycling the supply voltage, the NIRS31-UMB supply can be switched by a relay driven by GUB1.

7.2.5 Installing surge protection

The surge protection serves to protect the device against voltage spikes.

- Install the surge protection between the device and ISOCON-UMB converter.
- Refer the operating instructions of the surge protection.

8 Commissioning

8.1 Initial commissioning
During the initial commissioning of the device (for a period of 10 minutes) and the associated adaptation the following conditions must be met:

- ✓ the roadway must be completely dry
- ✓ no heavy traffic
- ✓ the power supply must not be interrupted
- ▸ Adjust the device only if the roadway is dry.

> If the roadway is not dry during commissioning, the adjustment must be performed manually in the UMB-Config-Tool, once the road is dry.

8.2 Device set-up
After the equipment has been installed and connected correctly, the device begins autonomously to take measurements.

The following is required for configuration and testing purposes:

- Windows® PC with serial interface
- ConfigTool.NET software

> Further information can be found in the User Manual Non Invasive Road Sensor.

Proceed as follows for commissioning:

- ▸ Check for correct equipment operation on site by carrying out a measurement request with the aid of the ConfigTool.NET software.
- ▸ If several road sensors are operated on a UMB network, assign a unique device ID to each sensor.

8.3 Changing operating mode
The following operating modes can be set:

Normal operation mode
Provided that the power supply is not limited, this mode is recommended because it is not restricted. In normal operation mode, all specified properties of the device are available.

Energy saving mode
If the power supply is limited, it is possible to operate the sensor in energy saving mode. In this mode the sensor samples only one time per minute. Between the measurements, the sensor is switched to a standby mode. Thereby the power consumption is reduced on average to lower than 35%

The energy saving mode has the following restrictions:

- The sampling and data update rate is fixed at 1 minute.
- The first 3 minutes after starting the device and during the measurement, the NIRS31- UMB is running at full capacity, therefore, the supply has to be designed for full power.

– The response time may be delayed.
– In case of rapid changes of the road conditions (e.g. onset of rainfall) it is used to measure more often to reduce the response time; thereby, the power consumption may increase slightly.
– In case of heavy traffic load, it is used to measure more often for a proper function of the noise suppression; this maybe increase the power consumption.
– Very high traffic load can cause interference of the measurement.
– Due to the low power, the sensor can freeze rather.

8.4 Configuration and testing

For configuration and testing OTT HydroMet Fellbach GmbH provides the proprietary software ConfigTool.NET. ConfigTool.NET can also be used to update the firmware of the device.

- Download the ConfigTool.NET software: www.otthydromet.com/en/software_firmware
- Install the software on the computer.
- Get familiar with the software in general.
- Ensure to always use the latest version of ConfigTool.NET.
- During configuration and testing, disconnect other devices that poll the UMB-Bus, e.g. modem or LCOM.
- Ensure that the connection settings of ConfigTool.NET are conform to the settings of the device.

i The operation of the ConfigTool.NET is described in detail in the help function of the Windows® PC software. For this reason only the menus and functions specific to the device are described below.

8.4.1 Factory settings

The device is delivered with the following settings:

Specification	Value
Class ID	5 (cannot be modified)
Device ID	1 (gives address 5001h = 20481d)
Baud rate	19200
RS-485 protocol	UMB binary
Operation mode	Normal
Calculation interval	10 measurements
Pyrometer offset	0 °C
Pyrometer emissivity	0.95
Water film moisture threshold	30 µm
Water film wetness threshold	100 µm

8.5 Selecting device

- Select the type of sensor.
  ⇨ The non-invasive road sensor appears in the selection menu as *NIRS31-UMB* (Class ID 5).
- Select **Configure**.
- Select **Load profile from sensor**.
- Select the *NIRS-UMB* tab.
- In *Device parameters* check the box *Renew Adaptation*.

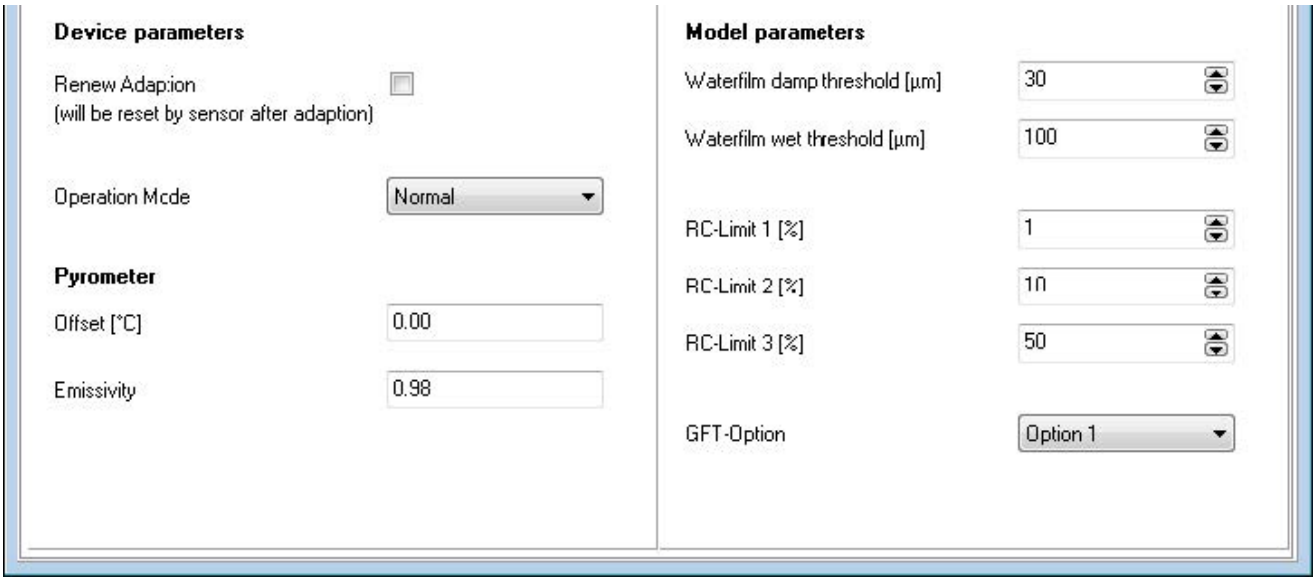
- Select the *Main* tab.
- Select **Store profile on sensor**.
- Confirm with **Save/Exit**.

8.6 General settings

Parameter	Description
Device-ID	Factory setting: 1 Assign the IDs for the devices in ascending order.
Description	To differentiate the devices enter a description, e.g. the location.
Linespeed	Transmission speed of the RS-485 interface Factory setting: 19200 DO NOT change for operation with ISOCON-UMB.
Protocol	Communication protocol of the device: UMB-Binary, UMB-ASCII, SDI-12
Timeout	In the event of a temporary changeover of the communication protocol, the system switches back to the configured protocol after this time (in minutes).

i If the baudrate is changed, after saving the configuration on the device, the device communicates at the new baudrate. When operating the device in a UMB network with ISOCON-UMB, this baudrate must not be changed; otherwise the device is no longer addressable and can no longer be configured.

8.7 Specific settings



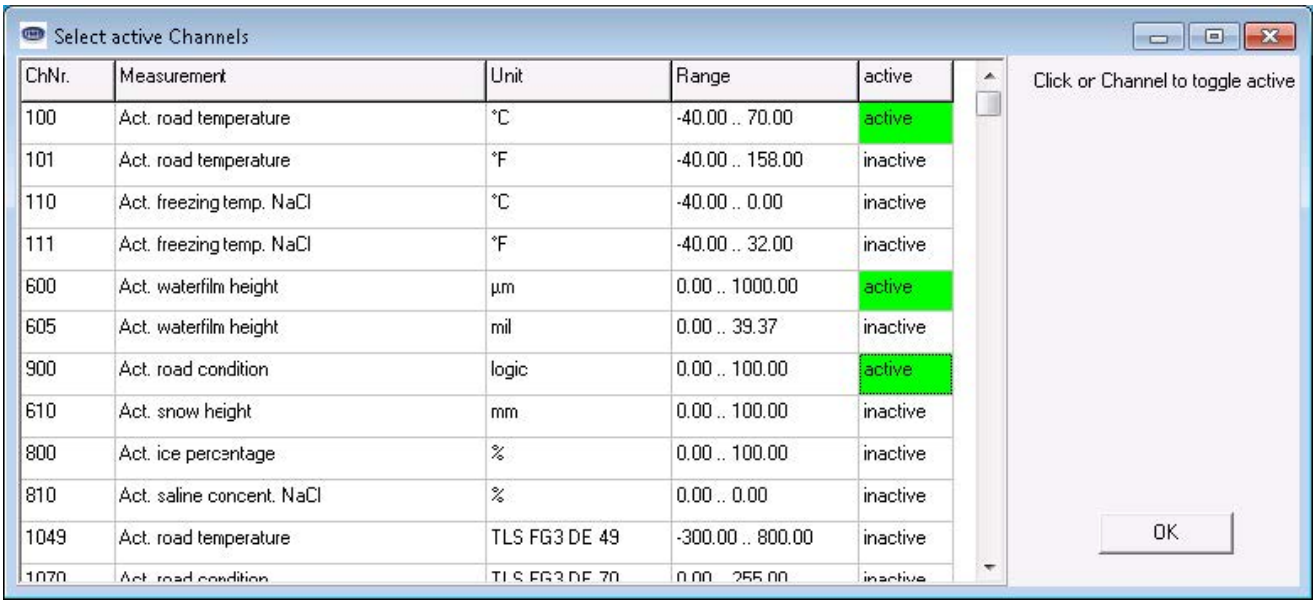
Parameter	Description
Renew adaption	The sensor performs a one-time new adjustment to the conditions prevailing at the installation.
Operation mode	The general operation mode of the sensor.
Offset	Absolute offset of the road surface temperature measurement in °C.
Emissivity	Emissivity of the road surface for the temperature measurement; the default setting 0.95 is an average value for all road surface types.

Parameter	Description
Waterfilm damp threshold	The road condition "damp" is transmitted with effect from this water film height. Note: On polling the TLS channel the condition 32 is transmitted with effect from this threshold.
Waterfilm wet threshold	The road condition "wet" is transmitted with effect from this water film height.

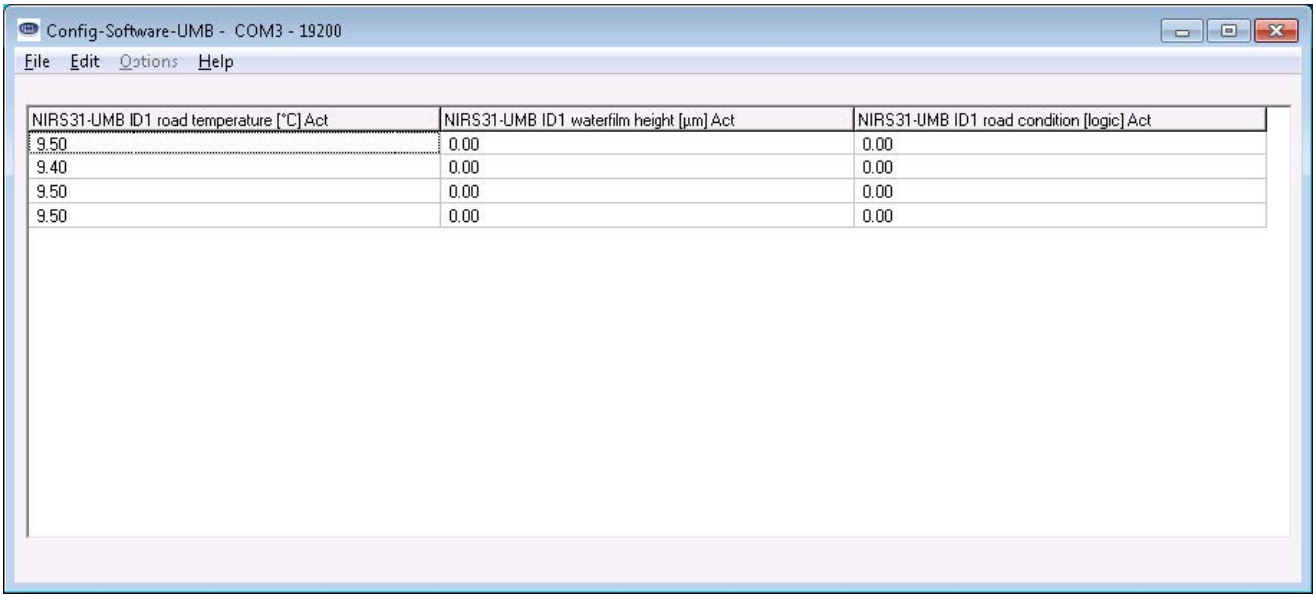
8.8 Testing

The functions of the device can be tested with the software ConfigTool.NET by polling various channels.

- Activate the desired channels.



Channels for measurement polling



Example of measurement polling

The ConfigTool.NET software is provided for test and configuration purposes only. The tool is not suitable for the permanent acquisition of measurement data. For this purpose the use of professional software is recommended, e.g. Lufft SmartView3.

9 Maintenance

9.1 Maintenance schedule

The frequency of cleaning is dependent upon the local weather and environmental conditions.

The following maintenance intervals are recommended:

Interval	Activity	Performed by
Annually	▸ Check the device for cleanliness. ▸ Clean the transmitter and receiver plates with a damp, lint-free cloth if dirty and dry with a dry, lint-free cloth. ▸ Carry out a visual inspection of the housing and clean, if dirty.	Operator
2 years	▸ Replace the reflector unit.	Operator

9.2 Replacing reflector unit

CAUTION

Risk of slight burns due to warm surface!

As soon as the device is connected to the power supply, the device starts to heat up. Touching the warm surface can be painful and can cause fright.

- ▸ Disconnect the device from the power supply and allow it to cool down.
- ▸ Wear protective gloves.

NOTICE

Damage due to water in housing!

Water ingress in the housing may cause damage to the housing or the optical parts.

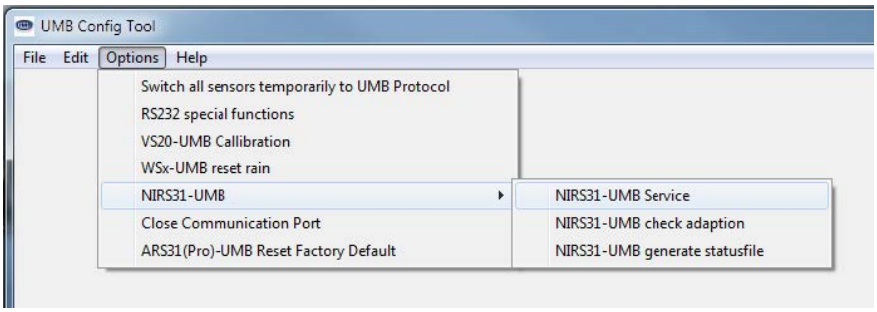
- ▸ Ensure to protect the device from moisture.
- ▸ Replace the reflector unit only in dry weather.

- ▸ Loosen the two screws on the front of the device.
- ▸ Hold the front of the device while loosening the screws to ensure that this part does not fall down.
- ▸ Remove the reflector unit connection cable and the three retaining springs. Do not touch the electronics of the sensor.
- ▸ Remove the reflector unit.
- ▸ Insert the new reflector unit and fit the retaining springs.
- ▸ Insert the plug connection into the main board. Do not trap the cable while closing the front of the device.
- ▸ Close the front of the device and insert the two screws.
- ▸ Fasten the screws with the hexagon socket wrench.

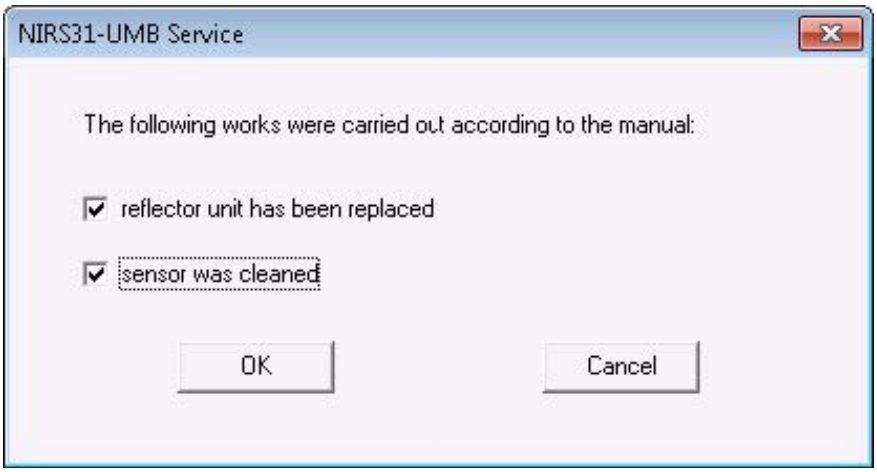
9.3 Resetting service level

After replacing the reflector unit, the service level must be updated in the UMB-Config-Tool.

- In the main menu in the *Options* drop-down list, select *NIRS31-UMB* and from the list *NIRS31-UMB Service*.



- Check the maintenance steps and confirm with **OK**.



9.4 Performing function test

To check the function of the sensor after maintenance, a function test must be performed.

- Test the functions of the device, as described in the chapterTesting [▸ 23].

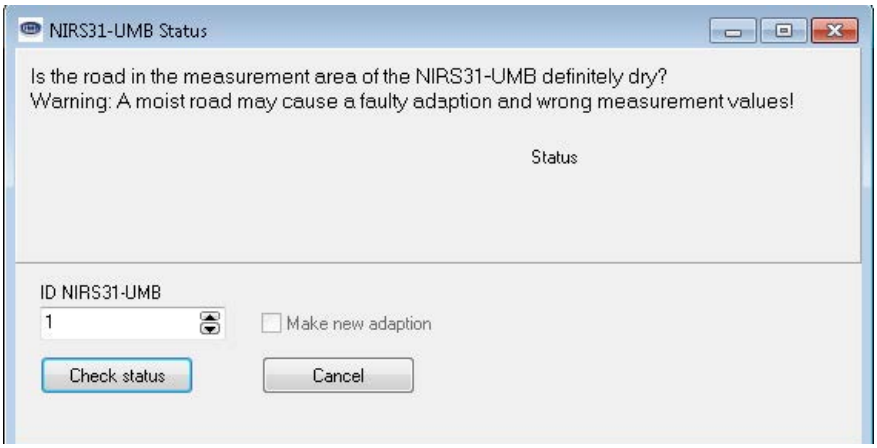
9.5 Checking sensor adjustment

The adjustment of the device is checked with the UMB-Config-Tool. During the period of checking the following conditions must be met:

- ✓ the roadway must be completely dry
- ✓ no heavy traffic
- ✓ last restart of the device at least 15 minutes before the sensor adjustment

- In the main menu in the *Options* drop-down list, select *NIRS31-UMB* and from the list *NIRS31-UMB check adaptation*.

- Check and adjust the device ID, if necessary, then click **Check status**.



  ⇨ A message appears stating whether the adjustment is correct.

- If the adjustment is not correct, repeat the adaptation.

9.6 Generating status file

- In the main menu in the *Options* drop-down list, select *NIRS31-UMB* and from the list *NIRS31-UMB generate statusfile*.
- Follow the given instructions.
- Contact customer support [▶ 28] for further analysis of the status file.

9.7 Updating firmware

The firmware can be updated with the ConfigTool.NET software. The firmware is valid for all types of the device. The description of the update can be found in the ConfigTool.NET software.

- Download the latest version of the firmware and the ConfigTool.NET software: www.otthydromet.com/en/software_firmware.
- Install the update on a Windows® PC.

10 Troubleshooting

10.1 Error elimination

Error	Possible cause	Corrective action
Device does not allow polling or does not respond	Device does not work properly	▸ Check the power supply. ▸ Check the interface connection.
Device does not allow polling or does not respond	Incorrect device ID is applied	▸ Check if the correct device ID is assigned. Devices are delivered with ID 1.
Device delivers implausible values	–	▸ Check if the sensor installation instructions are met.
Device delivers implausible values	Adaptation not suitable for installation location	▸ Repeat the adaptation using the UMB-Config-Tool.
Device transmits error value 24h (36d)	A channel is being polled that is not available on this device type	–
Device transmits error value 28h (40d)	Device is in the initialization phase following startup	▸ Wait until the first measurement is complete.
Device transmits error value 50h (80d)	Device is being operated above the limit of the specified measuring range	–
Device transmits error value 51h (81d)	Device is being operated below the limit of the specified measuring range	–
Device transmits error value 55h (85d)	Device is unable to execute a valid measurement due to ambient conditions, e.g. the measurement field is blocked by a vehicle	–
Device transmits an unknown error value	–	▸ Report any malfunction to the representative of OTT HydroMet.

11 Repair

11.1 Customer support

- Have repairs carried out by OTT HydroMet service personnel.
- Only carry out repairs yourself, if you have first consulted OTT HydroMet.
- Contact your local representative: www.otthydromet.com/en/contact-us
- Include the following information:

– instrument model
– instrument serial number
– details of the fault or problem
– examples of data files
– readout device or data acquistion system
– interfaces and power supplies
– history of any previous repairs or modifications
– pictures of the installation
– overview of the local environment conditions

12 Notes on disposing of old devices

Member States of the European Union

In accordance with the German Electrical and Electronic Equipment Act (ElektroG; national implementation of EU Directive 2012/19/EU), OTT HydroMet takes back old devices in the Member States of the European Union and disposes of them in the proper manner. The devices that this concerns are labeled with the following symbol:

- For further information on the take-back procedure contact OTT HydroMet:

OTT HydroMet Fellbach GmbH
Service & Technical Support
Gutenbergstraße 20
70736 Fellbach
Germany
phone: +49 711 518 22 0
email: met-support@otthydromet.com

All other countries

- Dispose of the product in the proper manner following decommissioning.
- Observe the country-specific regulations on disposing of electronic equipment.
- Do NOT dispose of the product in household waste.

13 Technical data

13.1 General technical data

Specification	Value
Fastening	Mast bracket for diameter 60 to 76 mm
Housing	Aluminum, plastic cover
Protection class	III (SELV)
Protection type	IP65
Operating temperature range	-40 to +60 °C
Humidity range	0 to 100 %
Storage temperature range	-40 to +70 °C
Humidity range (non-condensing, during storage)	0 to 95 %

13.2 Electrical data

Specification	Value
Power supply	24 V DC + 15 % / - 10 %
Nominal voltage supply	24 V DC
Power input	40 VA 15 VA in energy saving mode
Current consumption	Approx. 1.65 A at 24 V DC[1]
Inrush current	Approx. 32 A (50 µs) at 24 V DC

[1]Depending on the cable length, the power and current consumption change, e.g. with a cable length of 15 m, the current consumption is approx. 1.75 A.

13.3 Data transfer

Specification	Value
Interfaces/ protocols	RS-485 half-duplex, two-wire interface (UMB, SDI-12 protocol)
Data bits	8 (UMB) 7 (SDI-12)
Stop bit	1
Parity	No (UMB) Even (SDI-12)
Tri-state	2 bits after stop bit edge
Baudrate	19200 (UMB) 1200 (SDI-12)
Adjustable baud rates	1200, 2400, 4800, 9600, 14400, 19200, 28800, 57600

13.4 Dimensions and weight

Specification	Value
Dimensions (height x width x depth)	425 x 225 x 285 mm
Weight NIRS31	Approx. 9900 g
Weight mast bracket	Approx. 1000 g

13.5 Measuring range and accuracy

Road surface temperature

Specification	Value
Measurement process	Pyrometer
Measuring range	-40 °C to +70 °C
Resolution	0.1 °C
Accuracy	+/-0.8 °C
Sampling rate	1 minute
Units	°C; °F

Water film height

Specification	Value
Measurement process	Spectroscopic
Measuring range	0 to 2000 µm
Resolution	0.01 µm
Accuracy	+/-0.1 mm +/-20 % of measurement
Sampling rate	< 1 minute
Units	µm, mil

Ice layer thickness

Specification	Value
Measurement process	Spectroscopic
Measuring range	0 to 2000 µm
Resolution	0.01 µm
Sampling rate	< 1 minute
Units	µm, mil

Freezing temperature

Specification	Value
Measurement process	Spectroscopic
Measuring range	-40 °C to 0 °C
Resolution	0.1 °C

Specification	Value
Sampling rate	< 1 minute
Units	°C; °F

Ice percentage

Specification	Value
Measurement process	Spectroscopic
Measuring range	0 to 100 %
Resolution	0.1 %
Sampling rate	< 1 minute
Units	%

Saline concentration

Specification	Value
Measurement process	Spectroscopic
Measuring range	0 to 100 %
Resolution	0.1 %
Sampling rate	< 1 minute
Units	%

Snow height

Specification	Value
Measurement process	Spectroscopic
Measuring range	0 to 10 mm
Resolution	0.01 mm
Sampling rate	< 1 minute
Units	mm

Friction

Specification	Value
Measurement process	Spectroscopic
Measuring range	0 to 1
Resolution	0.01
Sampling rate	< 1 minute

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Contact Information